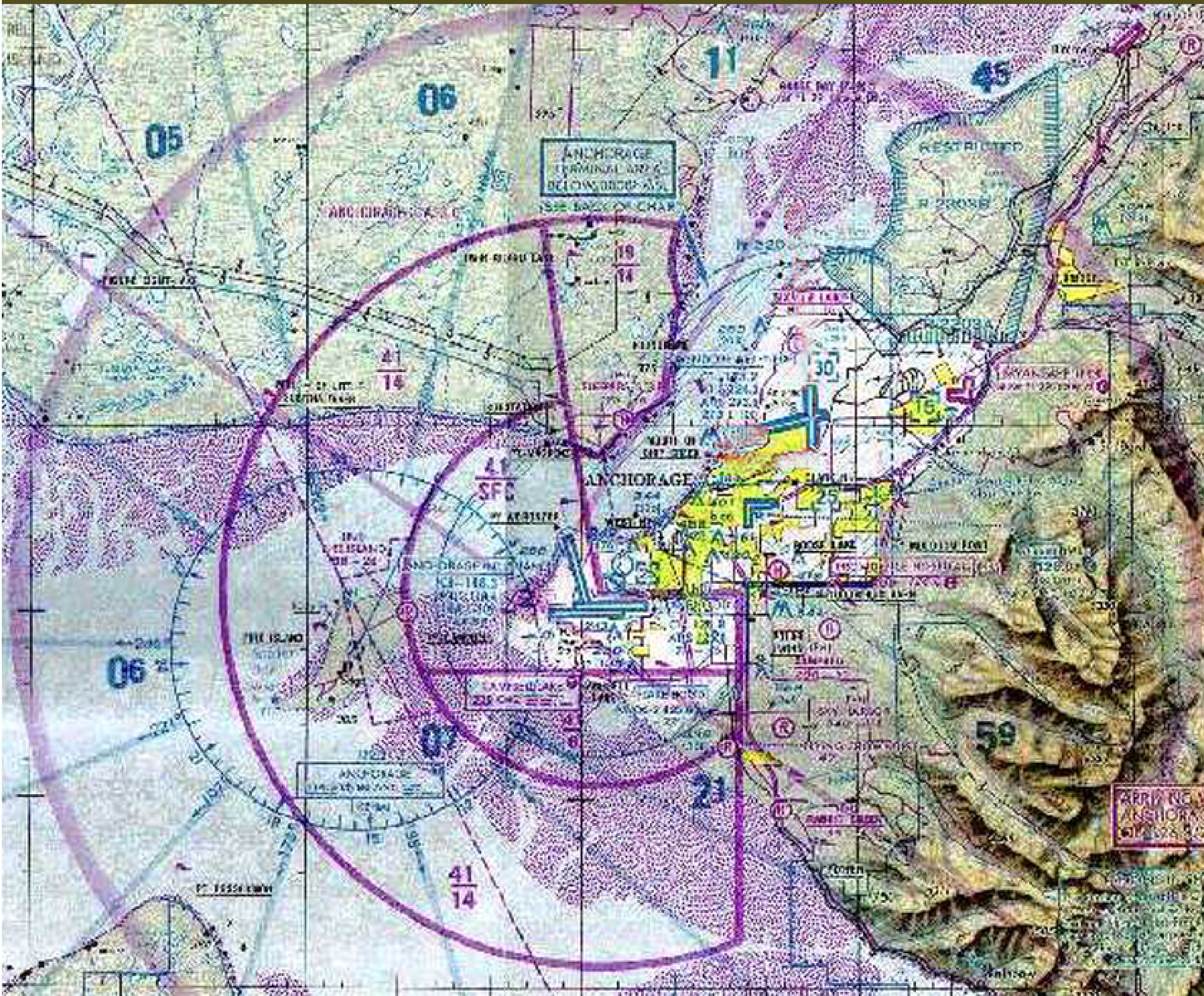
Anchorage Area Airspace Study

May 2001



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May 2001

Prepared jointly by the U.S. Department of Transportation,
the Federal Aviation Administration,

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Figure 1. Anchorage Area Airspace Diagram

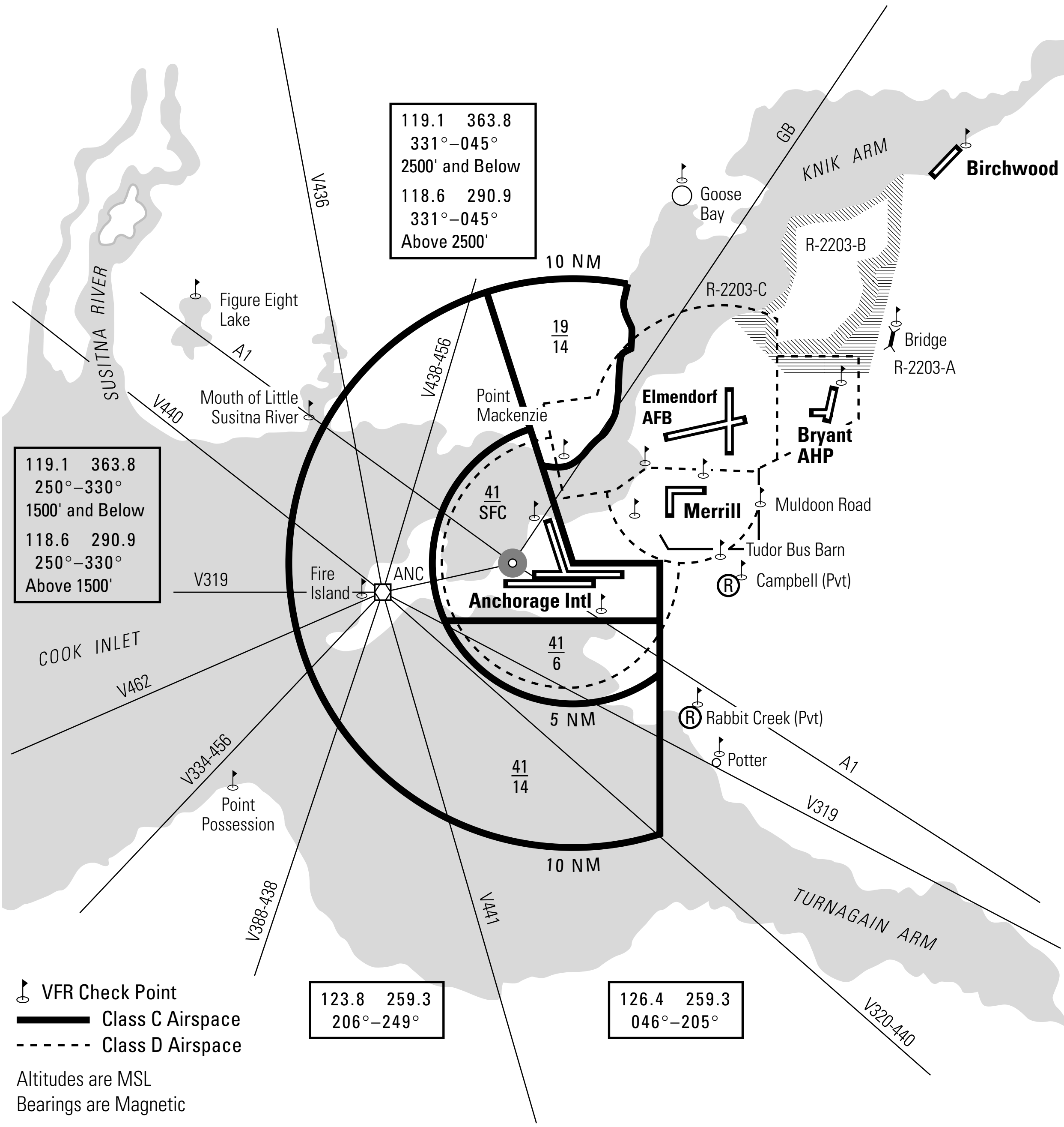


Figure 2. Alternatives and Annual Delay Savings

Operational Improvements	Configuration	Estimated Annual Delay Savings (HRS and $M) Baseline (504,043)	Future 1 (580,678)	Future 2 (670,125)
1. Localizer Directional Aid (LDA) ANC Runway 6R	A, D	41/$0.09	120/$0.44	Note 2
2. Simultaneous Offset Independent Approaches (SOIA) ANC Runway 6R	A, D	425/$0.94	3,356/$7.42	Note 4
3. Two Parallel Streams with ANC and EDF	A, D	0/$00.0	0/$00.0	Note 1
4. Simultaneous Converging Instrument Approaches (SCIA) Converging Runway Display Aid (CRDA)	B, E, G	0/$00.0	0/$00.0	Note 4
5. Charted Visuals to Runways 24	B	0/$00.0	0/$00.0	Note 1
6. CRDA ANC Departures Runway 32 EDF and Arrivals Runway 5	A, F	0/$00.0	0/$00.0	Note 4
7. Charted Visuals Runway 32	F	0/$00.0	0/$00.0	Note 1
8. LDA EDF Runway 5	ALL	59/$0.13	262/$0.58	Note 2
9. Reduction of EDF interaction on ANC/MRI/LHD. ANC and LHD interaction will still be present, as well as interaction between LHD and MRI.	ALL	2,786/$6.16	7,942/$17.56	Note 1
10. Alternative(s) to make operations by smaller, general aviation aircraft easier in the Anchorage Area. Potential VFR Flyways/Routes. (a) Identify possible east-west VFR corridor to segregate MRI, LHD and ANC general aviation operations from large aircraft arrivals to and departures from Runway 14-32 at ANC. (b) Eastern Departures Interaction with GA.	ALL	0/$00.0	0/$00.0	Note 3
11. New Ski/Tundra Tire Strip at MRI.	ALL	—	—	Note 5
12. Instrument Approach Procedure to MRI.	ALL	—	—	Note 5
13. Identification of potential locations for a Future Float Plane facility from an Airspace perspective.	ALL	—	—	Note 6
14. Instrument Approach Procedures to Bryant Field AHP.	ALL	0/$00.0	0/$00.0	
15. Dependent Converging Instrument Approach (DCIA) Runways 14 and 6R – combined with alternative 9.	G	3,487/$6.30	14,722/$19.43	Note 2
16. No Interaction Case (Alt 9) and LDA Runway 6R (Alt 1)	A, D	2,768/$6.12	7,911/$17.49	Note 2
17. No Interaction Case (Alt 9) and SOIA Runway 6R (Alt 2)	A, D	3,116/$6.89	10,824/$23.93	Note 2
18. Follow-On Airspace Study				

Notes: Note 1 – Alternative would not provide a delay benefit and was not annualized.

Note 2 – Alternative would not provide a delay benefit at Future 2.

Note 3 – Alternative not annualized; further study is required.

Note 4 – This procedure is still in the development stage and was not annualized.

Note 5 – Addressed in MRI Master Plan update.

Note 6 – Addressed in the General Aviation System Plan.

Note 7 – To Be Addressed in Bryant Field Master Plan.

Figure 3. Alternatives Studied and Recommended Actions

Operational Improvements	Configuration	Action	Time Frame
1. Localizer Directional Aid (LDA) ANC Runway 6R		A, D	More Study Needed
2. Simultaneous Offset Independent Approaches (SOIA) ANC Runway 6R		A, D	More Study Needed
3. Two Parallel Streams with ANC and EDF		A, D	Currently Used
4. Simultaneous Converging Instrument Approaches (SCIA) Converging Runway Display Aid (CRDA)		B, E, G	Recommended
5. Charted Visuals to Runways 24		B	Recommended
6. CRDA ANC Departures Runway 32 EDF and Arrivals Runway 5		A, F	Not Recommended
7. Charted Visuals Runway 32		F	Not Recommended
8. LDA EDF Runway 5		ALL	Recommended
9. Reduction of EDF interaction on ANC/MRI/LHD. ANC and LHD interaction will still be present, as well as interaction between LHD and MRI.		ALL	Recommended
10. Alternative(s) to make operations by smaller, general aviation aircraft easier in the Anchorage Area. Potential VFR Flyways/Routes.		ALL	Recommended
11. New Ski/Tundra Tire Strip at MRI.		ALL	Addressed in MRI Master Plan
12. Instrument Approach Procedure to MRI.		ALL	Addressed in MRI Master Plan
13. Identification of potential locations for a Future Float Plane facility from an Airspace perspective.		ALL	To Be Addressed in Anchorage Area System Plan
14. Instrument Approach Procedures to Bryant Field AHP.		ALL	Addressed In Bryant Field MP
15. Dependent Converging Instrument Approach (DCIA) Runways 14 and 6R – combined with alternative 9 during peak arrival periods.		G	Recommended
16. No Interaction Case (Alt 9) and LDA Runway 6R (Alt 1)		A, D	Recommended
17. No Interaction Case (Alt 9) and SOIA Runway 6R (Alt 2)		A, D	Recommended
18. Follow-On Airspace Study			Recommended

Executive Summary

The Federal Aviation Administration (FAA), airport operators, and representatives of the aviation industry initiated joint Airspace Capacity Design Teams or Study Design Teams at various major air carrier airports throughout the U.S. These Capacity Teams identify and evaluate alternative means to enhance existing airspace and airspace capacity to handle future demand. A Study Design Team for the Anchorage area airspace was formed in 1997.

Because of the close proximity of multiple airports, and levels and mix of aircraft operations, the Study Design Team recommended that modeling and analysis of the airspace in the Anchorage Bowl, including operations at Anchorage International Airport (ANC), Elmendorf Air Force Base (EDF), Merrill Field (MRI), and Lake Hood (LHD), and existing VFR corridors be incorporated into the Anchorage Area Airspace Study. The Study Design Team's objective was to use the airspace study and simulation modeling as a tool to evaluate alternatives to accommodate both the volume and mix of current and future aircraft operations in the Anchorage Area. The Study Design team was concerned that efforts to accommodate future operational levels at Anchorage International Airport would not be effective if the airspace infrastructure could not adequately handle the increase in operations. Therefore, to make the analysis more comprehensive, both airport and airspace infrastructure were modeled. Sources of delay associated with current airport infrastructure and the airspace structure for the Anchorage Area were identified for current 1997 operational level and for two future operational levels termed Future 1 and Future 2. The alternatives evaluated in this study to accommodate future aircraft operational levels, and to address current and future delays were limited to procedural enhancements of the existing airspace.

The Study Design Team identified and assessed various procedural enhancement actions which, if implemented, would reduce aircraft delays for the Anchorage Area, and improve operational efficiency. The purpose of the process was to conduct a preliminary assessment of the technical merits of each alternative action and its impact on capacity. Additional studies will be needed to fully assess the technical merits or each alternative and to assess environmental, socioeconomic, or political issues associated with these actions.

Selected alternatives identified by the Study Team were tested using SIMMOD, a computer model developed by the FAA to quantify the benefits provided. For the study, different levels of aircraft operations were chosen to represent growth in aircraft operations in order to compare the merits of each action. The total annual aircraft operations for all airports are referred to throughout this report as Baseline - 504,043 operations; Future 1 - 580,678 operations; and Future-2 - 670,125 operations.

Future 1 Definitions

ANC – A 25% increase over the current traffic level which is approximately the year 2008 forecast demand.

EDF – A 17% increase over the current traffic level which is approximately the year 2000 forecast demand.

LHD – A 7% increase over the current traffic level which is approximately the year 2010 forecast demand.

MRI – A 15% increase over the current traffic level which is reflective of the year 2008 forecast demand.

Future 2 Definitions

ANC – A 50% increase over the current traffic level which is approximately the year 2015 forecast demand.

EDF – The same as the Future 1 demand. It was decided that the traffic level for Future 2 would be the same, since the traffic would not increase much more beyond the Future 1 level.

LHD – An 11% increase over the current traffic level which is approximately the year 2015 forecast demand.

MRI – A 21% increase over the current traffic level which is reflective of the year 2015 forecast demand.

Explanation of Delays by Configuration

All Configurations – Most of the delay occurs during weather conditions that are VFR3 and less. One reason is the increase in aircraft separations. Also, the increase in demand from Baseline to Future 2 will cause higher delays. In those experiments with SVFR1 conditions, the high delays result from the interaction between EDF arrivals and MRI traffic. During SVFR1 conditions, the EDF arrival delay is higher during weekends due to a change in fleet mix and loss of priority for IFR traffic. This is the explanation for high delays for all configurations unless otherwise stated below.

Configuration A – During weather conditions that are VFR3 and less, the arrival runways 6R and 6L act as a single runway.

Configurations B, G – During SVFR1 conditions, MRI experiences a larger increase in delay due to the multiple interactions between MRI and arrivals to EDF. Also, arrivals from the northwest to LHD start to experience more delay during these conditions since they interact with MRI traffic. During SVFR1 conditions, arrivals to LHD experience higher delay due to the interaction with ANC arrivals.

Configurations B, E, G – The interaction between arrivals to ANC and arrivals to EDF cause the delays to be higher.

Configurations E, F – These are single runway configurations which limit your options.

Study Conclusion Summary

1 – As air traffic operational levels increase in the Anchorage Area, delays will increase dramatically, especially between the Future 1 and Future 2 operational levels.

2 – The procedural alternatives evaluated in this study will not provide a long-term solution to the projected future delays in the Anchorage Area. We do recommend assessing the feasibility of implementing the following procedural alternatives to reduce delays in the short term. These alternatives are focused on refinements to the existing airspace structure. Airfield and major airspace restructuring alternatives were not evaluated. Additional analysis will be needed to address long term delays in the Anchorage Area.

3 – Exhibit 2 presents the annual cost savings for the alternatives that are expected to provide a benefit. The annualized daily average delay at the Future 2 demand level for ANC exceeds 28 minutes even with the use of the proposed alternatives. Therefore, the Future 2 level of demand will not be achievable, unless other major capacity enhancements are implemented. Hence, the cost savings are shown for the Baseline and Future 1 demand levels only.

4 – The delay numbers depicted in this report represent both airport and airspace delays.

5 – This Airspace Study has provided valuable baseline data for ongoing and future planning related to airport master plans, aviation system plans, and airspace redesign and analysis.

Other planning studies are underway that will address some of the airspace and airport delay and capacity issues identified in this airspace study. These studies include: the Airspace Restructuring Initiative being conducted by the Alaskan Regional Air Traffic's personnel, the Master Plan updates for ANC and MRI, the Anchorage Area General Aviation System Plan, and possible additional planning for potential change in the mission of EDF. After these other planning studies are completed it is recommended that a second Anchorage Area Airspace study be conducted by a National FAA team, by the FAA's Alaskan Region, or through other means. The purpose of the second Anchorage Area Airspace study would be to evaluate the Anchorage wide impacts of these other study recommendations, to determine what airspace changes may be needed to accommodate airport infrastructure changes and to validate the effectiveness of the Airspace restructuring recommendations.

Exhibit 1 – Annual Delay Hours - All Airports

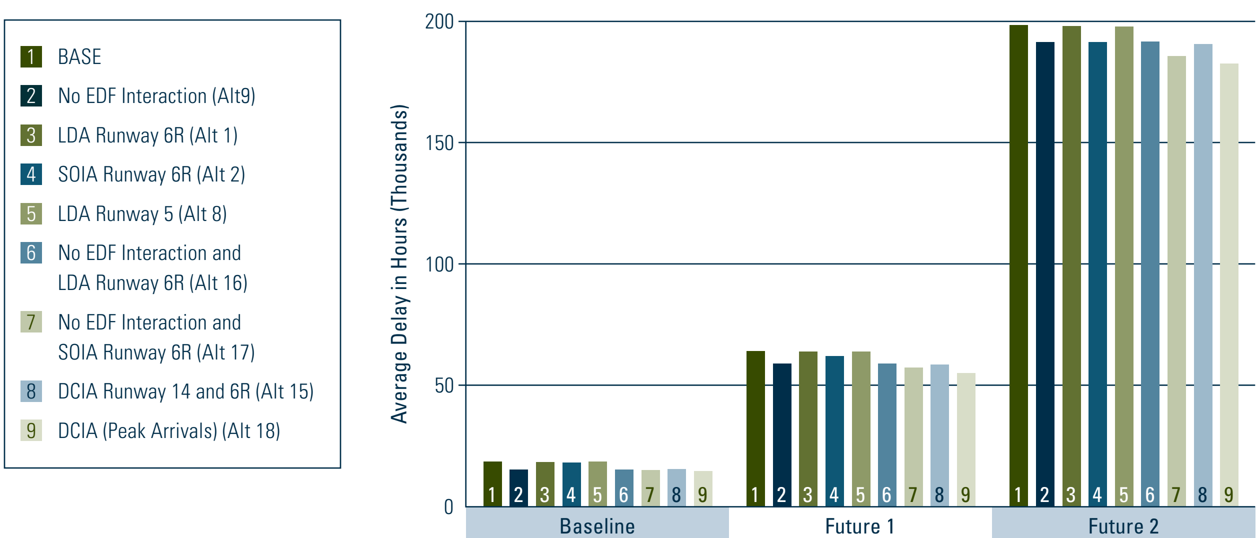
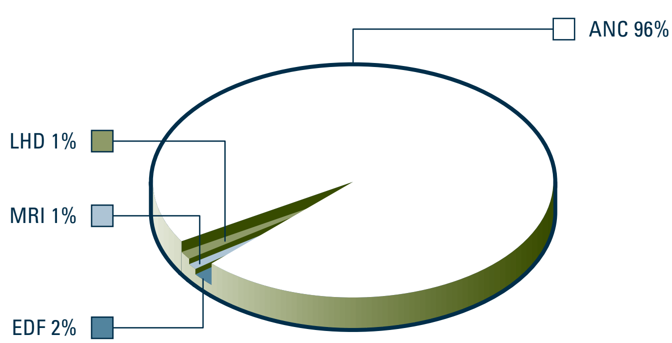


Exhibit 2 – Annual Delay Hour Percentages for F2 Demand - All Airports



Introduction

Background

In April of 1997, the Anchorage Area Airspace Study was initiated to evaluate the Anchorage area airspace. Because of their close proximity, and level and mix of aircraft operations, four airports were chosen in this evaluation, Anchorage International Airport (ANC), Elmendorf Air Force Base (EDF), Merrill Field (MRI), and Lake Hood (LHD). Additional corridor traffic was also added to increase the accuracy of the study and to show the affect of the airspace interactions.

The study involved the presentation of data packages, which provided model inputs and simulation results. A summary of the process follows:

1 – Presented initial model inputs such as configuration data, weather conditions, runway occupancy times, separation data, daily demand numbers, and arrival and departure airspace routes. A preliminary list of alternatives was also provided.

2 – Presented modifications to the initial model input lists that were agreed upon by the design team. This package also provided the initial airspace interaction descriptions between the four airports based on configuration and weather. New daily demand schedules were generated based on 1997 traffic data.

3 – Presented preliminary results for present demand level. Also, additional model inputs were provided.

4 – Presented initial configuration percentages based on weather information supplied by the National Climatic Center in Asheville, N.C. Simulation runs were made for a 25% and 50% increase in traffic for Anchorage International Airport.

Future 1 Definitions

ANC – A 25% increase over the current traffic level which is approximately the year 2008 forecast demand.

EDF – A 17% increase over the current traffic level which is approximately the year 2000 forecast demand.

LHD – A 7% increase over the current traffic level which is approximately the year 2010 forecast demand.

MRI – A 15% increase over the current traffic level which is reflective of the year 2008 forecast demand.

Future 2 Definitions

ANC – A 50% increase over the current traffic level which is approximately the year 2015 forecast demand.

EDF – The same as the Future 1 demand. It was decided that the traffic level for Future 2 would be the same, since the traffic would not increase much more beyond the Future 1 level.

LHD – An 11% increase over the current traffic level which is approximately the year 2015 forecast demand.

MRI – A 21% increase over the current traffic level which is reflective of the year 2015 forecast demand.

5 – Presented the refinement of the model inputs with regard to the interaction of the four airports. Provided the Future 1 and 2 traffic levels for all four airports. Provided annualized result data for the Baseline, Future 1, and Future 2 traffic levels.

6 – Presented the final baseline results for all simulated configuration and weather conditions. It also provided the results for the alternatives. The results are presented in annualized delays and costs.

Objectives

The purpose of the area airspace study was to identify and evaluate proposals to increase airspace capacity, improve airspace efficiency, and reduce airspace delays. Achieving this objective required the study design team to:

- Assess the current airport and airspace delay and interactions
- Examine the causes of delay associated with the immediate airspace and airport configuration for Anchorage International Airport.
- Evaluate capacity and delay benefits of alternative air traffic control (ATC) procedures, navigational improvements, and operational improvements
- Determine which airspace improvements would offer the most benefit in terms of increased capacity and reduced delays at Future 1, and Future 2 demand levels, and
- Determine at what level of operations new airport infrastructure, air traffic control procedures and airspace restructuring would be required for the terminal and adjacent en route airspace.

Scope

The scope of this study was to baseline the current and future traffic conditions and to evaluate alternatives that may increase capacity and reduce delay in the Anchorage area. The Study Design Team limited its analyses to aircraft activity within the terminal area airspace. They considered operational benefits of the proposed procedural, navigational and operational improvements, but did not address environmental, socioeconomic, or political issues regarding airspace restructuring. These issues need to be addressed in future planning and environmental studies. The data generated by the Study Design Team can be used in such studies.

Methodology

The Study Design Team, which included representatives from the FAA, the United States Air Force, the State of Alaska, Anchorage International, Lake Hood and Merrill Field Airports and various aviation groups (see Appendix A), met periodically for review and coordination. The Study Design Team members considered suggested airspace capacity improvements alternatives proposed by the FAA's Office of System Capacity, Technical Center, and Regional Aviation Capacity Program Manager, and by other members of the Team. Alternatives that were considered practicable were developed into experiments that could be tested by simulation modeling. The FAA Technical Center's Aviation Capacity Branch provided expertise in airspace simulation modeling.

The proposals for this Anchorage Area Airspace Study required detailed descriptions of the airspace and airfield representation. The Airport and Airspace Simulation Model (SIMMOD) was used for simulating the Anchorage Area. SIMMOD, a terminal airspace model, analyzed the airspace interactions occurring between arrivals and departures for a given airport, as well as the airspace interaction between multiple airports. SIMMOD also provided information on sources of delay associated with Anchorage International Airport's existing infrastructure.

SIMMOD is the FAA's Airport and Airspace Simulation Model. It can model the operations of airport and airspace systems ranging in size from an individual terminal gate to a major airspace route network. SIMMOD simulates the movement of every aircraft, step by step, along each segment of a flight or taxi path, resolving conflicts and monitoring the time and fuel consumed. Once the basic structure of the airport or airspace system has been prepared, SIMMOD can be used to develop and evaluate new alternatives by adjusting selected input parameters. A brief description of the model is included in Appendix B.

SIMMOD was loaded with data to reflect current operations in the Anchorage Bowl Area (e.g., airfield layouts, terminal airspace structures, aircraft flight tracks and schedules, and operating procedures). Simulation runs were conducted to compare SIMMOD results with actual traffic statistics in order to calibrate and verify model performance. Additional simulation runs were conducted for the baseline system with both the baseline and future traffic demands. Projected increases in operations at ANC, EDF, MRI, and LHD were included in the simulations, with particular emphasis being placed on the demand at arrival and departure gates. Analysis was conducted to determine at what point the existing capacity of the supporting airspace would be exceeded and, as demand continued to increased, to determine the delays that would be incurred with the current airspace system.

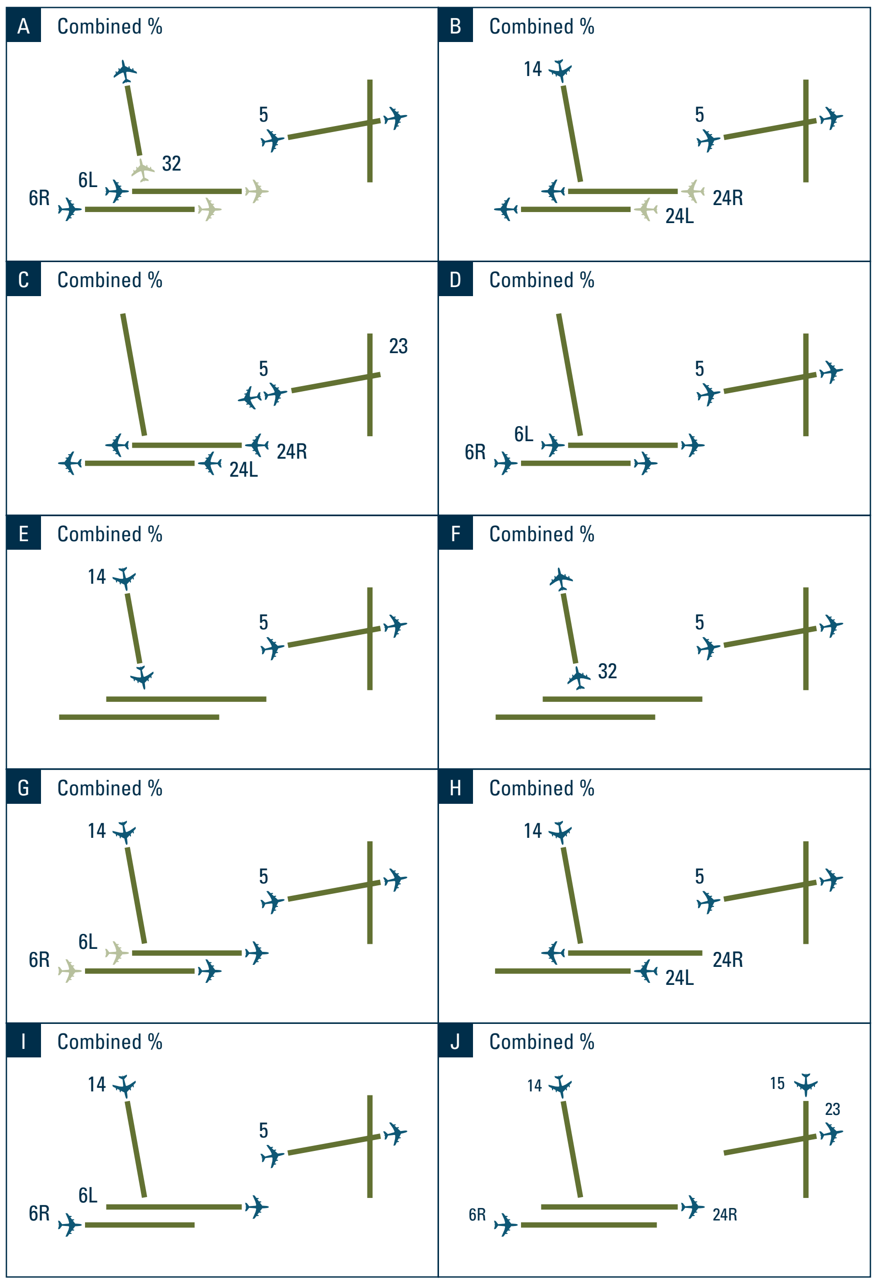
The airspace study concentrated on the arrival and departure fixes serving the Anchorage terminal airspace. Specific levels of traffic that represented the existing hourly capacity levels of each fix were provided for SIMMOD. The Baseline air traffic demand was then increased to the Future 1, and Future 2 demand levels to determine when existing capacity would be reached for each of the arrival and departure gates. Delays were calculated for each demand level. Upon completion of the simulation runs, sets of output were provided for analysis: A brief summary of the results from the analysis of each scenario follows in Section 2.

Configuration Data

Simulated Configuration

Figure 4 depicts the eight runway configurations that were studied. The configurations were based on ANC and EDF runway configurations. MRI and LHD were simulated in one configuration only. All other airports in the Anchorage Area were simulated via corridor traffic (e.g., traffic flowing North and South on the East and West sides of the Anchorage Area).

Figure 4. ANC/EDF Runway Configurations



Airport Interactions

The following describes the interactions between the airports for each configuration and weather condition. These descriptions were used as input into the model to simulate the complexities of the airport interactions.

Configuration A

VFR1 – When non-fighter type aircraft are on final to EDF, aircraft departing ANC Runway 32 will either hold until the EDF aircraft clears or the EDF aircraft will be vectored in order to maintain separation. Fighters use separate routing, therefore, there is no interaction with fighter aircraft. Visual Flight Rules (VFR) separations are used.

VFR2 – Same interaction as in VFR1 except all aircraft going to EDF must be sequenced with ANC departures on 32. VFR separations are used.

VFR3 – Same interaction as VFR2. In addition, ANC acts as a single runway. Instrument Flight Rules (IFR) separations are used for larger aircraft and VFR separations for smaller aircraft. Commuter traffic uses IFR separations.

SVFR1 – Same interaction as VFR3. In addition, IFR traffic has priority over Special Visual Flight Rules (SVFR) traffic. Special VFR allows pilots to fly in less than basic VFR conditions (less than 1000' ceiling and/or less than 3 miles visibility). All aircraft originating from MRI and going to the North/West or arriving from the North/West must be sequenced with EDF arrivals. All aircraft originating from LHD and going to the North/West or arriving from the North/West must be sequenced with EDF heavy arrival aircraft. All aircraft originating from and flying to LHD must be sequenced with ANC Runway 32 departures. MRI and LHD departures going to the same area (converging) must be sequenced. IFR separations are used.

SVFR2 – The only difference between SVFR1 and SVFR2 is the traffic reduction in SVFR2. There is a 45% reduction in special aircraft traffic. IFR separations are used.

IFR – ANC and EDF interactions only. No Special VFR traffic.

Configuration B

VFR1 – When non-fighter type aircraft are arriving at EDF, arrivals to ANC must be sequenced with them to allow for separation. Flow control used for both arrivals.

VFR2 – All aircraft landing at EDF must be sequenced with ANC arrivals. Flow control used for both arrivals.

VFR3 – Same as configuration A.

SVFR1 – Same as configuration A. In addition, LHD arrivals and ANC arrivals are dependent. LHD departures to the North/West must be visually separated with ANC arrivals.

SVFR2 – Same as SVFR1. In addition, ANC arrivals must land or be visually separated before LHD departures to the North/West can take off.

IFR – Same as configuration A.

Configuration C

VFR1 – No Interaction.

Configuration D

VFR1, 2, 3 – No Interaction.

SVFR1 – Same as configuration A. In addition, MRI south departures are dependent with Runway 6 ANC arrivals. LHD south and east departures are dependent with Runway 6 ANC arrivals.

SVFR2 – Same as above.

IFR – Same as configuration A.

Configuration E

Use same interactions as configuration B.

Configuration F

VFR1, 2 – Same interactions as configuration A.

Configuration G

Combine interactions of configurations B & D.

Note - All sequencing involving MRI, LHD, and EDF are the same for all configurations.

Explanation of Delays by Configuration

All Configurations – Most of the delay occurs during weather conditions that are VFR3 and less. One reason is the increase in aircraft separations. Also, the increase in demand from Baseline to Future 2 will cause higher delays. In those experiments with SVFR1 conditions, the high delays result from the interaction between EDF arrivals and MRI traffic. During SVFR1 conditions, the EDF arrival delay is higher during weekends due to a change in fleet mix and loss of priority for IFR traffic. This is the explanation for high delays for all configurations unless otherwise stated below.

Configuration A – During weather conditions that are VFR3 and less, the arrival runways 6R and 6L act as a single runway.

Configurations B, G – During SVFR1 conditions, MRI experiences a larger increase in delay due to the multiple interactions between MRI and arrivals to EDF. Also, arrivals from the northwest to LHD start to experience more delay during these conditions since they interact with MRI traffic. During SVFR1 conditions, arrivals to LHD experience higher delay due to the interaction with ANC arrivals.

Configurations B, E, G – The interaction between arrivals to ANC and arrivals to EDF cause the delays to be higher.

Configurations E, F – These are single runway configurations which limit your options.

Weather Conditions

Exhibit 3 shows the weather conditions that will be simulated for this study. The ceiling and visibility breakdowns were chosen based on changes in airspace procedures during those weather conditions.

Exhibit 3 – Weather Conditions

Weather	Description
VFR1	3,500’ Ceiling and 3 mile Visibility
VFR2	2,100’ Ceiling and 3 mile Visibility (Vector for visual approaches)
VFR3	1,000’ Ceiling and 3 mile Visibility (Run IFR conditions)
SVFR1	< 1,000’ Ceiling and 3 mile Visibility
SVFR2	< 1,000’ Ceiling and down to 1 mile Visibility
IFR	< 1,000’ Ceiling and < 1 mile Visibility

Configuration Percentages

Exhibit 4 is the percent use of each configuration based on weather conditions for both summer and winter months. This data was calculated using 10 years of weather data supplied by the National Climatic Center in Asheville, N.C. The summer percentages are based on the months June through October. The configuration percentages are based on wind rose data supplied by ANC using the Anchorage Air Traffic Control Tower (ATCT) Runway Selection Guide. When the crosswind component was between 0 to 10 knots, the configuration percentage was based on the Noise Abatement & Preferential Runway Use Program (bulletin no. 96-09).

Exhibit 4 – Configuration Percentages

Summer Percentages – Windrose Data Based On Airport Data

	Con A	Con B	Con C	Con D	Con E	Con F	Con G	Total
VFR1	30%	18%	1%	7%	12%	1%	21%	**90%**
VFR2	2%	1%	0%	0%	0%	0%	1%	**4%**
VFR3	1%	1%	0%	0%	0%	0%	1%	**3%**
SVFR1	1%	0%	0%	0%	0%	0%	0%	**1%**
SVFR2	0%	0%	0%	0%	0%	0%	0%	**0%**
IFR	1%	1%	0%	0%	0%	0%	0%	**2%**
Total	**35%**	**21%**	**1%**	**7%**	**12%**	**1%**	**23%**	**100%**

Winter Percentages – Windrose Data Based On Airport Data

	Con A	Con B	Con C	Con D	Con E	Con F	Con G	Total
VFR1	34%	4%	1%	18%	2%	5%	5%	**69%**
VFR2	2%	1%	0%	1%	0%	0%	1%	**5%**
VFR3	2%	0%	0%	1%	0%	0%	0%	**3%**
SVFR1	0%	0%	0%	0%	0%	0%	0%	**0%**
SVFR2	8%	1%	0%	3%	0%	0%	1%	**13%**
IFR	6%	1%	0%	2%	0%	0%	1%	**10%**
Total	**52%**	**7%**	**1%**	**25%**	**2%**	**5%**	**8%**	**100%**

Because of the conditions during the winter months in the Anchorage area, it was determined that an increase in runway occupancy times was needed. The predicted increases ranged from 25% to 50%. It was decided that a 35% increase was to be used, which was close to the average. This equated to about a 20-second increase in runway occupancy times. With an increase in runway occupancy times, an increase in arrival/arrival separations was needed to allow time for the aircraft to exit off the runway, thus avoiding a missed approach. An additional 20 seconds, which equated to .7nm, was added to the arrival/arrival separations to avoid the possibility of a missed approach.

Annual Configuration Percentages

The annual percentage totals, presented in Exhibit 5, are based on the configuration percentages shown in Exhibit 4. The percentages were then separated into summer (42%) and winter (58%) yearly values. In addition, the summer schedule was separated into weekday (71%) and weekend (29%) percentages. The winter data were not separated into weekday and weekend, since the daily traffic counts did not change much in the winter months.

Exhibit 5 – Average Annual Percent Breakdown

	Summer Percentages – Windrose Data Based On Airport Data							Weekday
	Con A	Con B	Con C	Con D	Con E	Con F	Con G	Total
VFR1	8.95%	5.37%	0.30%	2.09%	3.58%	0.30%	6.26%	27%
VFR2	0.60%	0.30%	0.00%	0.00%	0.00%	0.00%	0.30%	1%
VFR3	0.30%	0.30%	0.00%	0.00%	0.00%	0.00%	0.30%	1%
SVFR1	0.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
SVFR2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
IFR	0.30%	0.30%	0.00%	0.00%	0.00%	0.00%	0.00%	1%
Total	10%	6%	0%	2%	4%	0%	7%	30%

	Summer Percentages – Windrose Data Based On Airport Data							Weekend
	Con A	Con B	Con C	Con D	Con E	Con F	Con G	Total
VFR1	3.65%	2.19%	0.12%	0.85%	1.46%	0.12%	2.56%	11%
VFR2	0.24%	0.12%	0.00%	0.00%	0.00%	0.00%	0.12%	0%
VFR3	0.12%	0.12%	0.00%	0.00%	0.00%	0.00%	0.12%	0%
SVFR1	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
SVFR2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
IFR	0.12%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
Total	4%	3%	0%	1%	1%	0%	3%	12%

	Winter Percentages – Windrose Data Based On Airport Data							
	Con A	Con B	Con C	Con D	Con E	Con F	Con G	Total
VFR1	19.72%	2.32%	0.58%	10.44%	1.16%	2.90%	2.90%	40%
VFR2	1.16%	0.58%	0.00%	0.58%	0.00%	0.00%	0.58%	3%
VFR3	1.16%	0.00%	0.00%	0.58%	0.00%	0.00%	0.00%	2%
SVFR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
SVFR2	4.64%	0.58%	0.00%	1.74%	0.00%	0.00%	0.58%	8%
IFR	3.48%	0.58%	0.00%	1.16%	0.00%	0.00%	0.58%	6%
Total	30%	4%	1%	15%	1%	3%	5%	58%

Demand Levels and Traffic

Demand Levels

The simulations will consist of three demand levels (daily aircraft schedules), Baseline, Future 1, and Future 2. The baseline demand schedule for both summer and winter are based on 1997 traffic schedules and tower counts. Exhibit 6 shows the baseline daily demand levels for all airports. The Future 1 and Future 2 demand levels are presented in terms of percent increases over the baseline demand level.

Exhibit 6 – Baseline Daily Demand Levels

Airport	Season	Day	Arrival	Departure	Total
ANC	Summer	Weekday	407	403	**810**
ANC	Summer	Weekend	354	362	**716**
ANC	Winter	Both	329	329	**658**
EDF	Both	Weekday	89	89	**178**
EDF	Summer	Weekend	12	12	**24**
MRI	Summer	Weekday	183	179	**362**
MRI	Summer	Weekend	257	258	**515**
MRI	Winter	Both	90	90	**180**
LHD	Summer	Weekday	204	203	**407**
LHD	Summer	Weekend	284	279	**563**
LHD	Winter	Both	40	40	**80**
VFR Corridor	Summer	Both	–	–	**420**
VFR Corridor	Winter	Both	–	–	**226**

Future 1 Definitions:

ANC – A 25% increase over the current traffic level which is approximately the year 2008 forecast demand.

EDF – A 17% increase over the current traffic level which is approximately the year 2000 forecast demand.

LHD – A 7% increase over the current traffic level which is approximately the year 2010 forecast demand.

MRI – A 15% increase over the current traffic level which is approximately the year 2008 forecast demand.

VFR Corridor – Traffic increases are based on MRI percentages.

Future 2 Definitions:

ANC – A 50% increase over the current traffic level which is approximately the year 2015 forecast demand.

EDF – The same as the Future 1 demand. It was decided that the traffic level for Future 2 would be the same, since the traffic was not projected to increase much more beyond the Future 1 level.

LHD – An 11% increase over the current traffic level which is approximately the year 2015 forecast demand.

MRI – A 21% increase over the current traffic level which is reflective of the year 2015 forecast demand.

VFR Corridor – Traffic increases are based on MRI percentages.

MRI IFR Traffic

MRI has IFR traffic, which was not simulated. The small number of IFR aircraft did not justify the need for the added model complexity in obtaining these results. It should be noted that representatives from MRI indicated that these IFR flights incur significant delays in SVFR1, SVFR2, and IFR weather conditions during arrival operations to Runway 5 at EDF.

Annual Operations

Exhibit 7 shows the annual itinerant operations for each airport that will be used in the annual delay and cost calculations. The annual airport operations for ANC were obtained from the Airport Master Plan study by HNTB. The annual airport operations for EDF, MRI, and LHD were calculated using the daily operations (annualized based on day and season) multiplied by 365.

Exhibit 7 – Annual Itinerant Airport Operations

	Airport				
	ANC	EDF	MRI	LHD	Total
Baseline	259,354	58,225	100,302	86,162	**504,043**
Future 1	301,000	70,606	116,756	92,316	**580,678**
Future 2	379,000	70,606	124,334	96,185	**670,125**

Operating Costs and Annualizations

Operating Costs

The following operating costs are based on 1996 values derived from the Bureau of Transportation Statistics (BTS). These costs per minute values will be used in determining the annual delay costs for each airport, as well as, the cost savings for each alternative. The 1996 values were used since the data included information from Form 41 and Alaskan Form 298-C, which provided a more inclusive sample of aircraft types. Exhibits 8 through 11 provide a detailed cost estimate by aircraft type for each airport simulated. In some cases, if an aircraft was not found in the database an equivalent aircraft type was used. Cost does not include ground support equipment.

Exhibit 8 – ANC Operating Costs

Baseline Demand	Cost Per Hour ➢	$2,210.91
Future 1 Demand	Cost Per Hour ➢	$3,666.50
Future 2 Demand	Cost Per Hour ➢	$4,813.89

Because of an increase in cargo operations for future demand years at ANC, a separate cost per minute value was calculated. The increases of B747 and other heavy cargo aircraft created a significant increase in the cost per minute.

Exhibit 9 – EDF Operating Costs

Baseline Demand	Cost Per Hour ➢	$3,668.39
Future 1 Demand	Cost Per Hour ➢	$3,668.39
Future 2 Demand	Cost Per Hour ➢	$3,668.39

The cost data presented in Exhibit 9 were obtained from EDF.

Exhibit 10 – MRI Operating Costs

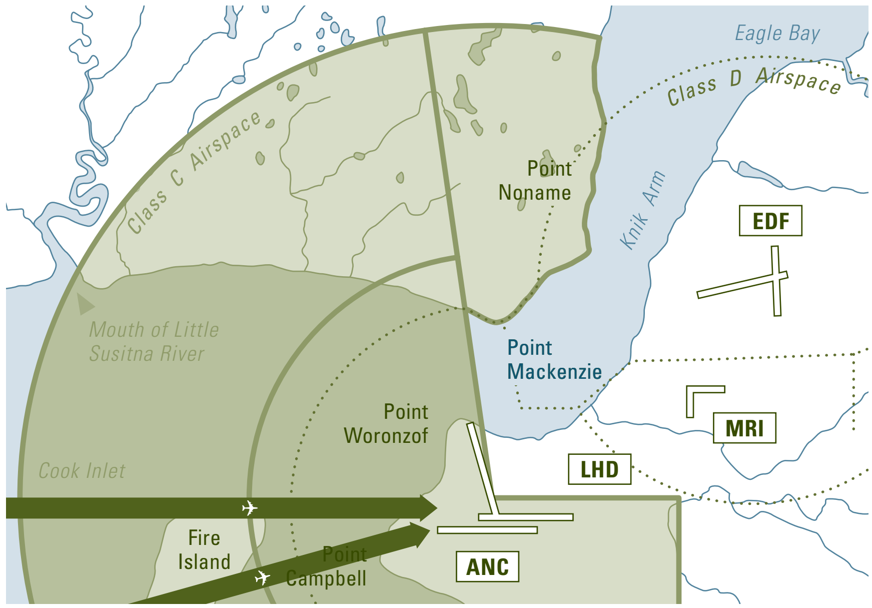
Baseline Demand	Cost Per Hour ➢	$102.53
Future 1 Demand	Cost Per Hour ➢	$102.53
Future 2 Demand	Cost Per Hour ➢	$102.53

Exhibit 11 – LHD Operating Costs

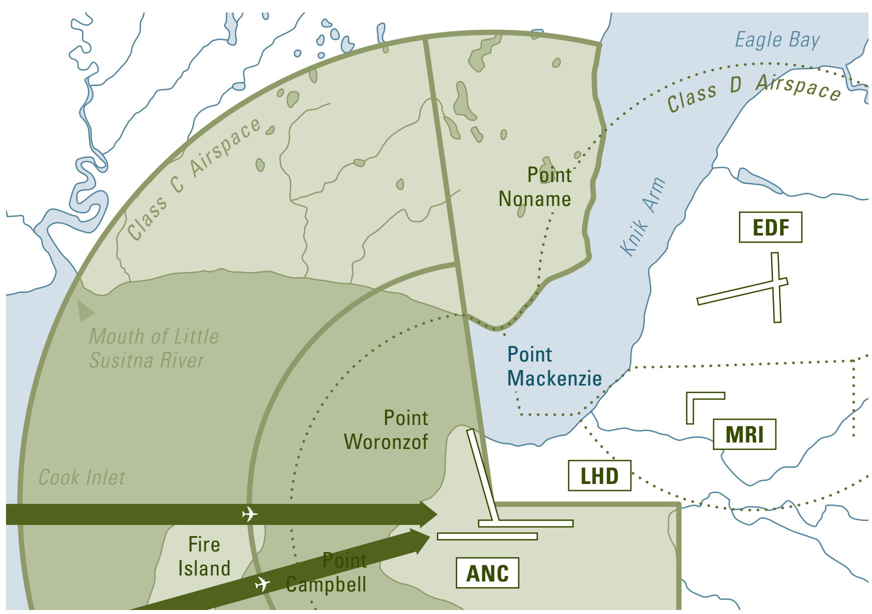
Baseline Demand	Cost Per Hour ➢	$98.40
Baseline Demand	Cost Per Hour ➢	$98.40
Baseline Demand	Cost Per Hour ➢	$98.40

Alternatives

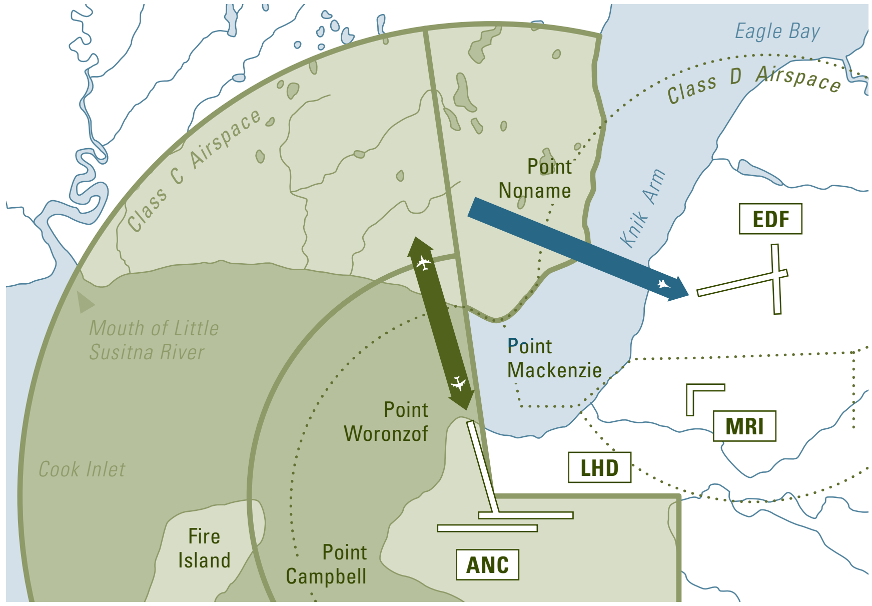
Alternative 1
LDA Runway 6R



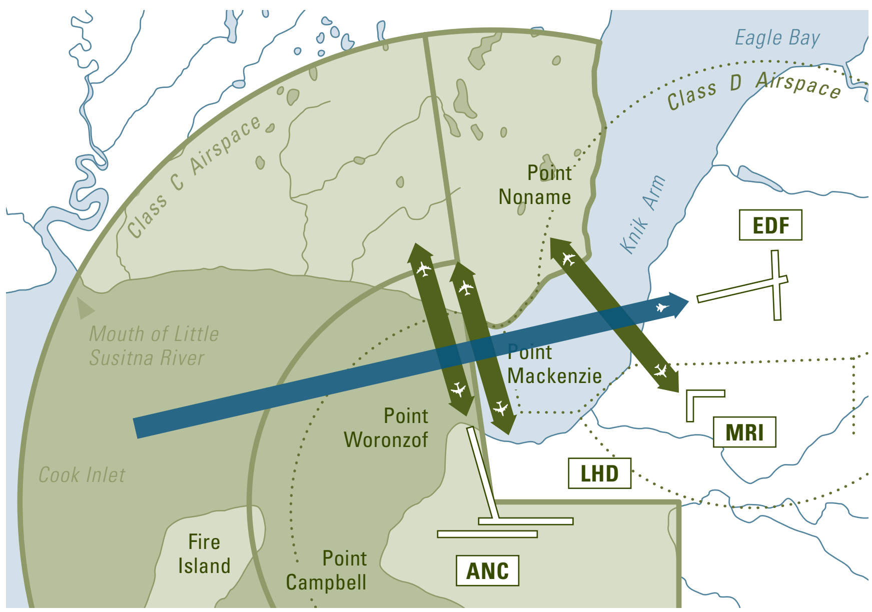
Alternative 2
SOIA Runway 6R



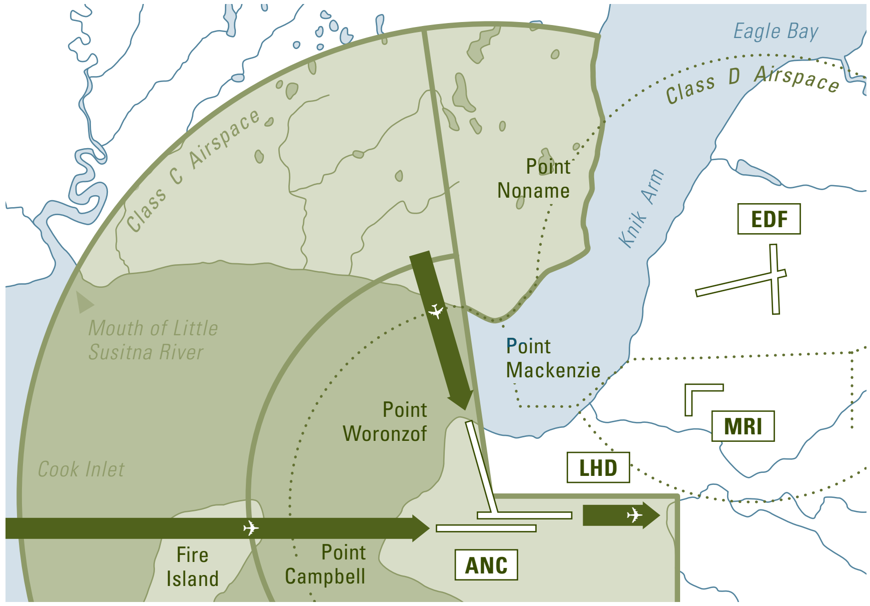
Alternative 8
LDA Runway 5



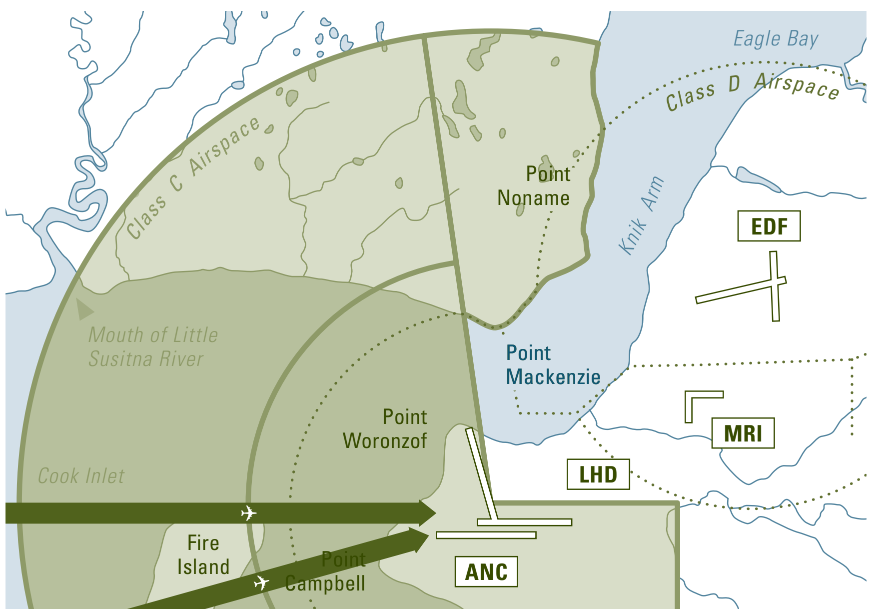
Alternative 9
No EDF
Interaction



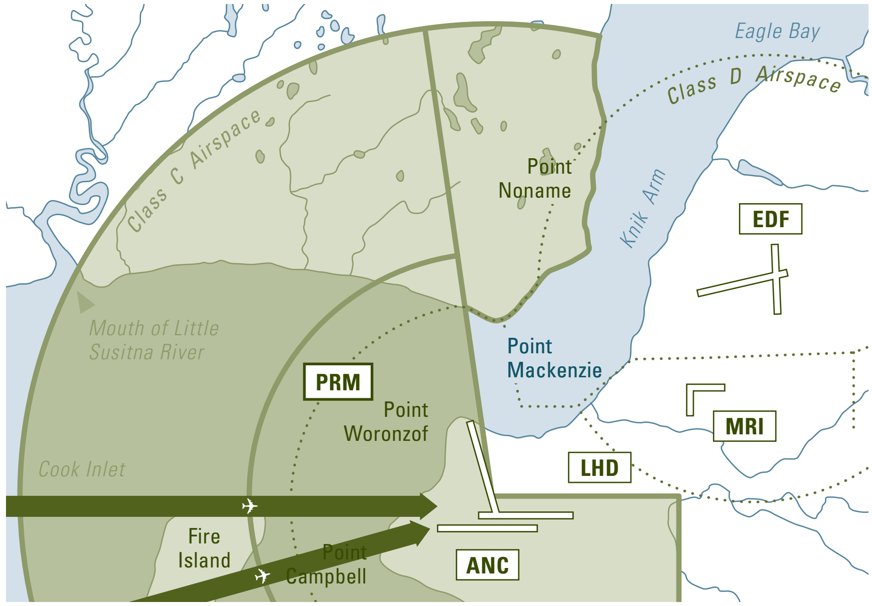
Alternative 15 DCIA Runway 14 and 6R



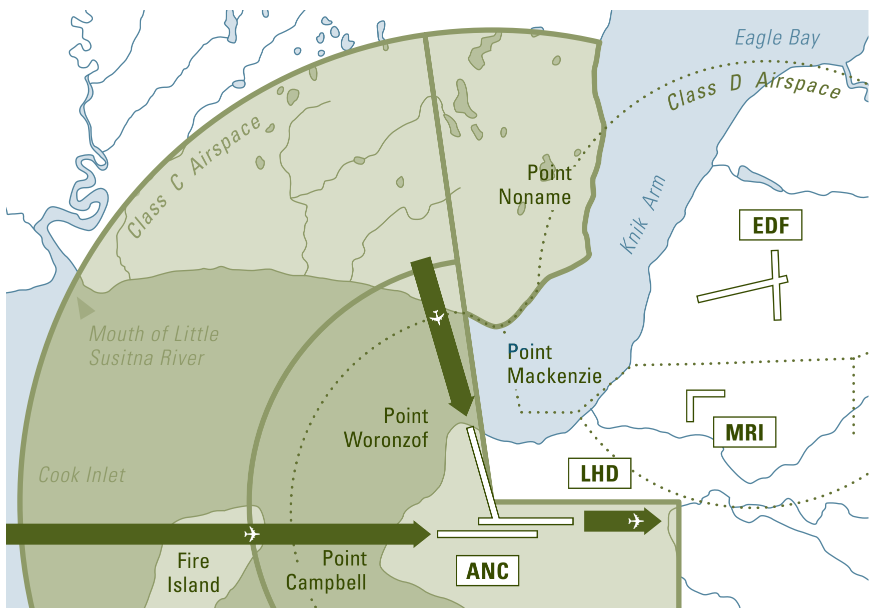
Alternative 16 No EDF Interaction and LDA Runway 6R



Alternative 17
No EDF
Interaction and
SOIA Runway 6R



Alternative 18
DCIA
(Peak Arrivals)



Alternative Descriptions

1 LDA Runway 6R – Localizer Type Directional Aids (LDAs) are used for non-precision instrument approaches. Although they offer the utility and accuracy of a localizer course, LDAs are not aligned with the runway nor do they provide any vertical guidance. The use of LDA approaches in conjunction with an ILS on adjacent, very closely-spaced parallel runways allows an additional arrival stream in weather minima lower than those required for visual approaches. The expected minima for an LDA are approximately 3,000' and 5 miles. Because the frequency of occurrence is unknown, and to get an estimated "maximum" benefit of this alternative, it will be annualized by using VFR1 delay values for VFR2 weather conditions under configurations A and D. This alternative would allow for two arrival flows, one to Runway 6R that is offset to the South and a straight-in flow to Runway 6L.

The potential annual savings for this alternative is $.09 million at the Baseline demand level and $.44 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 34.78 minutes.

More Study Needed – to determine feasibility of implementation. Further considerations: Consider combining with alternative 2 in a phased approach. Requires special crew training. Further evaluation needed to determine whether procedure can be implemented with staggered thresholds. Use of procedure requires special crew training, additional equipment in the ATCT and installation of an offset localizer at ANC. Potential crossing conflicts would have to be evaluated for wake turbulence (i.e. Smaller Aircraft arriving from the south would be routed to 6L). This procedure is typically used at locations with a homogeneous mix of aircraft and fairly stable weather conditions.

2. SOIA Runway 6R – A combination of technology and procedures called Simultaneous Offset Instrument Approaches (SOIA) is being developed. This combination can increase capacity at airports with closely spaced parallel runways. Using a Precision Runway Monitor (PRM), an offset ILS localizer and glide slope, and a new procedure, SOIA may be able to reduce the minima for simultaneous approaches to parallel runways with centerlines as little as 700 feet apart. A SOIA approach to Runway 6R will allow parallel arrival streams in less than VFR1 weather. The expected minima for SOIA are approximately 1,600' and 4 miles. Because the frequency of occurrence is unknown, and to get an estimated "maximum" benefit of this alternative, it will be annualized by using VFR1 delay values for VFR2 and VFR3 weather conditions under configurations A and D.

The potential annual savings for this alternative is $.94 million at the Baseline demand level and $7.42 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 33.67 minutes.

More Study Needed – to determine the feasibility of implementation. Further Considerations: Further evaluation needed to determine whether procedure can be implemented with staggered thresholds. Use of procedure requires additional crew training and proficiency, additional equipment in the Aircraft and ATCT, and installation of a Precision Runway Monitor. Potential crossing conflicts would have to be evaluated for wake turbulence (i.e. Smaller Aircraft arriving from the south would be routed to 6L). This procedure is typically used at locations with a homogeneous mix of aircraft and fairly stable weather conditions.

3. Two Parallel Streams with ANC and EDF – This alternative is currently done today using vectoring. The controller is unable to put aircraft on long finals to both airports simultaneously since the finals intersect. However, the controller can do that for one airport and run a vector stream to the other airport keeping the spacing between the finals. Running an LDA to EDF and moving the final approach course further to the northwest would create problems with VFR aircraft in the Pt. Mackenzie area. This would be impractical at ANC because of the parallel runways. You would need to make the 6L final the one that moved further to the south. This would then cross the 6R final, which is not recommended. This alternative would impact Federal Air Regulation (FAR) 93. Because of the spacing problems mentioned above, this alternative would not provide a delay saving benefit and therefore, was not annualized.

Not Recommended for Further Evaluation – This procedure is currently used by Anchorage for approaches

4. SCIA and CRDA ANC Arrivals Runway 14 and EDF Arrivals Runway 5 – The SCIA rules permit simultaneous ILS approaches to non-intersecting arrival runways. The CRDA tool will assist controllers in maintaining arrival aircraft stagger distances by providing an electronic "ghost" image. This alternative should provide some benefit with the interaction between arrivals to ANC Runway 14 and arrivals to EDF Runway 5. The delay reduction would be minimal since configurations B, E, and G are not used often under less than VFR1 conditions. However, during those periods when this configuration is in use, the operational benefits would allow the controller to maintain a safer and more efficient flow of traffic. This procedure, using a CRDA between two airports, is still in the development stage and therefore, was not annualized.

Recommended for Further Evaluation – Further considerations: Technology not available at this time, but further review of this alternative is warranted. Use of the Converging Runway Display Aid for Simultaneous Converging Instrument Approaches at 2 different Airports (i.e. ANC and EDF) has not been done elsewhere. Since this procedure has potential safety and efficiency benefits in this application, it is worthwhile considering the Anchorage Area as a location to study use of this technology for procedural enhancements to 2 Airports.

5. Charted Visuals to the 24's – This includes an approach to 24R used for large/heavy aircraft and an approach to 24L for the lighter commuter class. The approach to 24L would be a tighter approach, remaining inside of the 24R approach. The approaches would be developed using Inertial Navigation System (INS)/Global Positioning System (GPS) or visual landmarks, or some combination. The advantages would be keeping aircraft on a known flight track. This may make it easier for trailing aircraft to follow and could improve arrival rates. However, since separations are visual and the pilot now only has the ability to adjust speed to maintain spacing, separations might even increase overall depending on the skill of the pilots involved. Another downside is that every aircraft follows the same flight track across town, creating environmental concerns. Because of the problems mentioned above, this alternative would not provide a benefit and therefore, this alternative was not annualized.

Recommended for Further Evaluation – Further considerations: There may be some benefit to using this procedure to limit interaction between air carrier and general aviation aircraft and to tying arrival routes from the east down. The heavies could arrive to 24R and the lighter aircraft to 24L. More evaluation needed to determine whether of not this procedure would have a capacity benefit.

6. CRDA ANC Runway 32 Departures and EDF Runway 5 Arrivals – The CRDA tool will assist controllers in maintaining arrival aircraft stagger distances by providing an electronic “ghost” image. During periods of heavy Runway 5 arrivals, the traffic flows are not always the most efficient. Aircraft practicing ILS instrument approach procedures to EDF are often the cause of the interaction between Runway 32 departures and Runway 5 arrivals. However, during those periods when this configuration is in use, the operational benefits would allow the controller to maintain a safer and more efficient flow of traffic. This procedure, using a CRDA between two airports, is still in the development stage and therefore, was not annualized.

Not Recommended for Further Evaluation.

7. Charted Visuals to Runway 32 – This alternative is not expected to provide any benefit. Since all aircraft are heading for the same runway, it is probably more expeditious to have the controller set up the spacing. Once an aircraft is cleared for visual, you lose speed control of the aircraft, which could increase the separation between aircraft. In this case, a controller would rather vector the aircraft and only clear him for the visual close in to the airport so that control and spacing is maintained as long as possible. Because of the problems mentioned above, this alternative would not provide a benefit and therefore, this alternative was not annualized.

Not Recommended for Further Evaluation.

8. LDA to EDF Runway 5 – Localizer Type Directional Aids (LDAs) are used for non-precision instrument approaches. Although they offer the utility and accuracy of a localizer course, LDAs are not aligned with the runway nor do they provide any vertical guidance. The use of LDA approaches in conjunction with an ILS on adjacent, very closely-spaced parallel runways allows an additional arrival stream in weather minima lower than those required for visual approaches. Straight-in minimums may be published where alignment does not exceed 30 degrees between the course and runway. An LDA to EDF Runway 5 would provide benefits in eliminating the interaction with other airports. This alternative will be annualized by using the VFR1 delay values for VFR2 weather conditions for all configurations. This alternative would allow simultaneous instrument arrivals at ANC and EDF. This would also allow simultaneous Runway 32 departures and Runway 5 arrivals, as well as, Runway 14 arrivals and Runway 5 arrivals. This alternative would impact FAR 93.

The potential annual savings for this alternative is $.13 million at the Baseline demand level and $.58 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 34.72 minutes.

Recommended for Further Evaluation – Further considerations: Combine with alternative 9. The LDA to runway 5 at EDF could be the first step in reducing or eliminating EDF interaction. This procedure would likely impact the VFR routes in the north of ANC and west of EDF. The LDA to runway 5 at EDF should be looked at in conjunction with an LDA to runway 14 at ANC. An additional offset localizer would be required at EDF and ANC. Additional Land acquisition needed for the localizer installation at EDF and possibly at ANC.

9. Elimination of EDF interaction on ANC/MRI/LHD – The elimination of EDF interaction was simulated to show the benefit achievable through procedural changes in the system. This alternative eliminated the interactions between EDF and ANC, LHD, and MRI. The interactions between ANC, LHD, and MRI still exists due to the proximity of the airports. The procedure implemented to eliminate the interaction (ex. new approach) has no bearing on the results. Further study is required to determine a procedure that will eliminate this interaction.

The potential annual savings for this alternative is $6.16 million at the Baseline demand level and $17.56 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 32.09 minutes.

Recommended for Further Evaluation – Further Considerations: Development of a procedure to eliminate EDF interaction will be very costly requiring considerable airport and airspace infrastructure development, and will not be fully achievable.

10. Alternatives to make GA operations easier in the Anchorage area
a.) In today's configurations, there are terrain constraints to the East side of FAR 93 airspace and Chugach Mountains to get three separate corridors developed. A nonstandard Class C airspace design already exists that does not meet the charter of what Class C airspace is supposed to accomplish, hence the Seward Highway Segment. With positive control, there would not be a need for separate corridors, but more along the lines of an inbound and outbound corridor serving all airports along the way. There could still be room for nonparticipating aircraft closer to the hills. This would provide positive control to all classes of customers. This alternative will require further study and was not annualized.

b.) Develop a charted VFR route for aircraft arriving and departing the Anchorage Bowl Airports in the area North of the shoreline of Cook Inlet. This route would provide separation from IFR traffic operating to and from ANC and EDF, which includes Runway 14 arrivals and Runway 32 departures. This alternative will require further study and was not annualized.

Recommended for Further Evaluation.

11 and 12. New Ski/Tundra Tire Strip at MRI and Instrument Approach Procedure Capability to MRI – Both of these alternatives have been addressed in the MRI Master Plan update.

13. Identification of potential locations in Anchorage Area for a Future Float Plane facility from an Airspace perspective – This alternative will be addressed in the Anchorage Area General Aviation System plan.

14. Instrument Approach Procedures to Bryant Field – This is consistent with Army National Guard's proposed future development. Any approach procedure to Bryant Field would impact operations at EDF. Also this would impact the requested procedure to Birchwood.

15. DCIA Runways 14 and 6R – The DCIA requires CRDA, Automated Radar Tracking System (ARTS) software, and Digitized Airport Surveillance Radar. The CRDA tool will assist controllers in maintaining the stagger distance established between aircraft using DCIA. The DCIA order requires that aircraft be separated 2NM from a non-heavy ghost target and 5 NM from a heavy ghost target. Consequently, a slot is lost when there is a heavy arrival. This improvement will permit arrivals to Runway 14 and Runway 6R in IFR conditions. This alternative will be combined with alternative 9 since the interaction with EDF would cause a greater complexity when controlling three arrival streams. This alternative was be simulated for configuration G in IFR weather conditions. Currently, the preferred configuration is A. This means that when the wind is not a factor in runway assignment, configuration A is used. This alternative will utilize Configuration G during periods of peak arrivals. A small increase in Runway 6 departures may occur during this heavy arrival period.

The potential annual savings for this alternative is $7.71 million at the Baseline demand level and $32.55 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 30.68 minutes.

Recommended for Further Evaluation.

16. Combined Alternatives 1 and 9 – This alternative combines the LDA to Runway 6R and the elimination of the EDF interaction.

The potential annual savings for this alternative is $6.12 million at the Baseline demand level and $17.49 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 32.11 minutes.

Recommended for Further Evaluation.

17. Combined Alternatives 2 and 9 – This alternative combines the SOIA to Runway 6R and the elimination of the EDF interaction.

The potential annual savings for this alternative is $6.89 million at the Baseline demand level and $23.93 million at the Future 1 demand level. Even with this improvement, Future 2 would not be feasible because the average annual delay per operation would be 31.15 minutes.

Recommended for Further Evaluation.

18. Follow-On Airspace Study – It is recommended that a second Anchorage Area Airspace Study be conducted incorporating the studies listed in the following section. Other planning studies are underway that will address some of the airspace and airport delay and capacity issues identified in this airspace study. These studies include: the Airspace Restructuring Initiative being conducted by the Alaskan Regional Air Traffic's personnel, the Master Plan updates for ANC and MRI, the Anchorage Area General Aviation System Plan, and possible additional planning for potential change in the mission of EDF. After these other planning studies are completed it is recommended that a second Anchorage Area Airspace study be conducted by a National FAA team, by the FAA's Alaskan Region, or through other means. The purpose of the second Anchorage Area Airspace study would be to evaluate the Anchorage wide impacts of these other study recommendations, to determine what airspace changes may be needed to accommodate airport infrastructure changes and to validate the effectiveness of the Airspace restructuring recommendations.

Recommended for Further Evaluation.

Other Anchorage Area Studies

Other planning studies are underway that will address some of the airspace and airport delay and capacity issues identified in this airspace study. These studies include: the Airspace Restructuring Initiative being conducted by the Alaskan Regional Air Traffic's personnel, the Master Plan updates for ANC and MRI, the Anchorage Area General Aviation System Plan, and possible additional planning for potential change in the mission of EDF. After these other planning studies are completed it is recommended that a second Anchorage Area Airspace study be conducted by a National FAA team, by the FAA's Alaskan Region, or through other means. The purpose of the second Anchorage Area Airspace study would be to evaluate the Anchorage wide impacts of these other study recommendations, to determine what airspace changes may be needed to accommodate airport infrastructure changes and to validate the effectiveness of the Airspace restructuring recommendations.

Airspace Restructuring Initiative

Anchorage Air Route Traffic Control Center (ARTCC) – Anchorage Terminal Radar Approach Control Facility (TRACON) Joint Airspace and Procedures Workgroup

A workgroup has been formed to evaluate the arrival and departure flows in the Anchorage Bowl Area. The workgroup is comprised of controllers and management representatives from Anchorage ATCT, Anchorage TRACON and Anchorage ARTCC. Proposed action has been divided into near term (Summer of 2000/2001) and long term solutions (Summer of 2002 and beyond).

For the near term, controller workload has been redistributed through internal Approach Control Sector modifications. The result is a feeder/final concept that enhances capacity by keeping consistent arrival pressure on the runways.

Long range modifications being discussed at this time include:

- *Four Corner Post Arrival Concept* – This would increase capacity and safety by proceduralizing the interactions.
- *Expanding Approach Control Airspace* – This will allow additional room for sequencing arrivals and provides additional routes for departure traffic.
- *Additional Navaid Requirements* – Modifications of the arrival/departure flows may require additional land based navigational aids.

- *Modification of Standard Instrument Departure (SID's) and Standard Terminal Arrival Routes (STARS)* – This will allow for prolonged use of pilot navigated procedures that provide separation from other routes.
- *Increased Radar Coverage North of Anchorage* – Increased use of low level military training routes, general aviation activity and additional instrument approach procedures is pointing out a need for Air Traffic Control Radar Coverage in the Northern Matanuska Valley area.
- *Combining Approach and Enroute Radar Facilities* – Combining these two functions would remove present day hardware and software limitations, which impact arrival and departure flows. Another benefit of combining the facilities would be seen in the traffic management area; interfacility coordination and communication would be seamless and more effective.

This is a preliminary list of items the workgroup intends to evaluate during the coming several months.

Anchorage International Airport Master Plan

The Master Plan Update will address improvements to the airfield that can increase capacity and reduce delays. Examples of improvements to be considered include new and/or improved runways, new and realigned taxiways, high speed runway exits, and appropriate locations for deicing activities. Planning will be completed in coordination with the FAA, users and the public.

Anchorage Area General Aviation System Plan

The State Department of Transportation (DOT) and Public Facilities (PF) will be initiating work on a General Aviation System Plan for the Anchorage Area the fall of 2000. This plan is funded primarily through the Federal Aviation Administration's Airport Improvement Program. This study will assess the need for and evaluate the feasibility of improvements to existing and new general aviation facilities in the Anchorage area. A technical advisory committee and public meetings will be used to obtain input from the general aviation community on identification of requirements for additional facilities, evaluation of alternatives and development of a strategic implementation plan. Some, but not all, of the issues that will be evaluated in the plan include the need for additional an float plane operation area, alternatives to accommodate the mix of operations at the Birchwood Airport, and other issues identified by the general aviation community during a 1998 survey conducted by DOT and PF.

Merrill Field Master Plan

The Master Plan Update for Merrill Field is nearing completion. The most significant change associated with the master plan update is the addition of a new runway to accommodate operations by tundra tire and ski equipped aircraft. The new gravel/ski traffic patterns will be incorporated into the traffic patterns for the existing runways. Other improvements to accommodate the forecast growth in operations and to reduce runway incursions are also included in this Master Plan Update.

Elmendorf Air Force Base Plan

As operations increase and the use and mission of EDF changes, it is recommended that the Air Force conduct a planning effort with other affected stakeholders to assess alternatives to accommodate growth and change in operations taking into account airspace interactions with operations from other airports.

Summary of Technical Studies

The Anchorage Area Airspace Study Team evaluated the efficiency of the existing airfield and the proposed future configurations. Exhibit 3 illustrates airfield weather conditions and Figure 3, runway utilization. The potential benefits of various improvements were determined by examining airfield capacity, airfield demand, and average aircraft delays.

The Capacity Team used the FAA's Airport and Airspace Simulation Model (SIMMOD) to determine aircraft delays during peak periods. Delays were calculated for current and future conditions.

Daily operations corresponding to an average day in the peak month were used for each of the forecast periods. Daily delays were annualized to measure the potential economic benefits of the proposed improvements. The annualized delays provide a basis for comparing the benefits of the proposed changes. The benefits associated with various runway use strategies were also identified.

Exhibit 12 presents the annual daily average delay for all airports as average delay in minutes. The exhibit includes data for the baseline simulations as well as the alternatives that were expected to provide some benefit.

The cost of a particular improvement was measured against its annual delay savings. This comparison indicates which improvement will be the most effective.

For expected increases in demand, a combination of improvements can be implemented to allow airfield capacity to increase while aircraft delays are minimized.

Exhibit 12 – Annual Daily Average Delay for All Airports

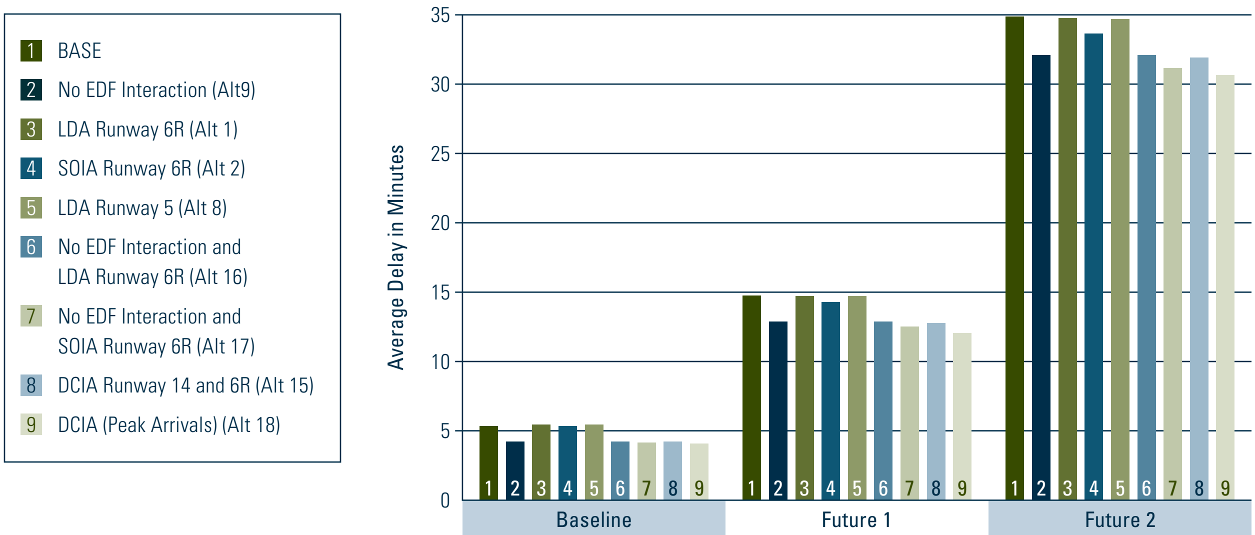


Exhibit 13 presents the annual delay in hours for all airports. The annual delay hours were calculated by multiplying the total annual operations by the average delay per minute then dividing by 60.

Exhibit 13 – Annual Delay Hours - All Airports

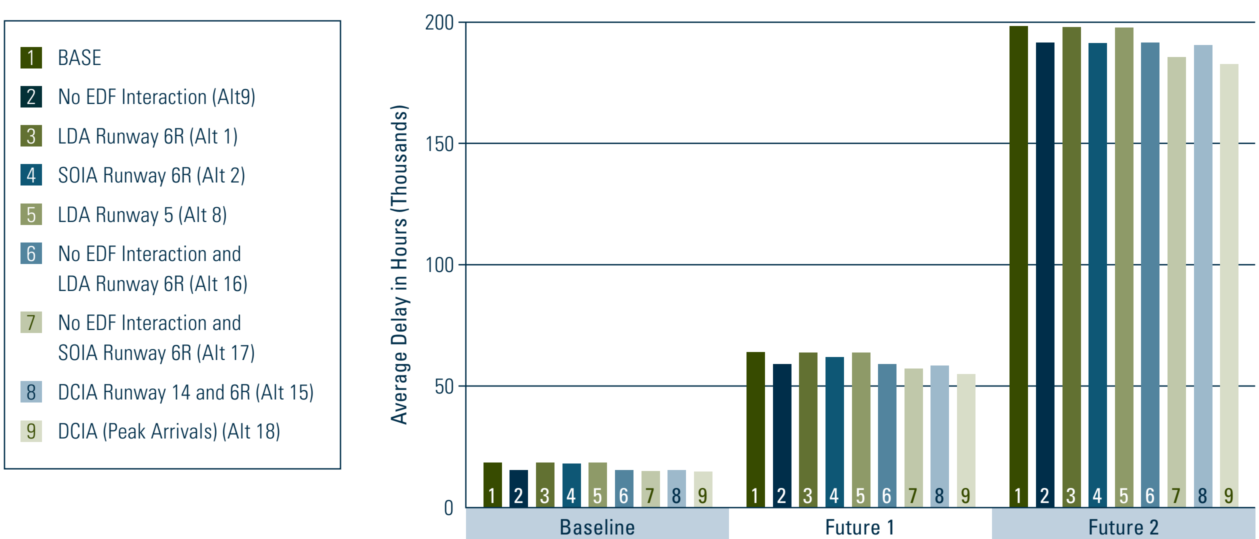
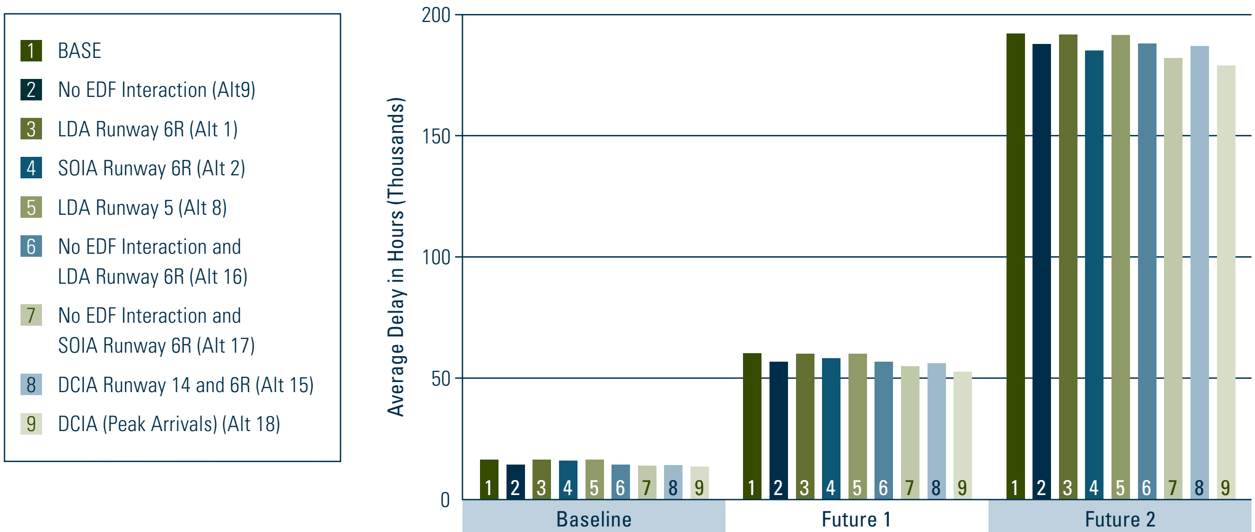


Exhibit 14 presents the annual delay hours for ANC. The chart indicates that ANC will still suffer from high delays at the Future 2 demand level, even with the elimination of the EDF interaction and the additional alternatives. The high delays can be attributed to the lack of runway/taxiway facilities, the increase in traffic, and the increase in the percentage of heavy aircraft. Air Traffic at ANC has indicated that the EDF interaction is a problem, although the results do not seem to indicate this. To show the affects of the EDF interaction, a sensitivity analysis was performed. The results of the analysis are discussed on the next page.

Exhibit 14 – Annual Delay Hours - ANC



EDF Interactions

Air Traffic has indicated that the EDF interaction has a significant impact on ANC, although the results do not seem to indicate this. It should be noted that the traffic schedule used for EDF was an average and does not reflect peak periods of traffic. An average traffic schedule for EDF was used because of the varied traffic. It would be impractical to simulate all permutations of those schedules. A representative from EDF confirmed that it would be difficult to give an answer as to how to capture a representative schedule. A sensitivity analysis was performed to see if the EDF interaction did have an affect on ANC operations. Four test cases were simulated using Configuration A. The VFR2 weather condition was chosen since all arrival aircraft to EDF must follow the same final approach course. A Future 1 schedule was chosen so that a busy departure hour could be depicted. In each case, an increasing number of EDF arrivals during a busy ANC departure time were simulated to show the impact of EDF to departures on

Runway 32. For each case, the average departure delay per aircraft in that hour, as well as, the average departure delay per aircraft for that day are presented. The following table shows the results for each case.

Case	Number of ANC Departures for One Hour	Number of EDF Arrivals for One Hour	Average ANC Departure Delay in that Hour	Average ANC Departure Delay in that Day
1	33	6	2.96	2.04
2	33	21	4.51	2.07
3	33	26	4.81	2.26
4	33	36	7.33	2.33

As one can see by the results, the EDF interaction would significantly impact departures on ANC during a given hour depending on the schedule of EDF traffic. However, the average delay per day increases only slightly. Therefore, the annualized delay values show very little impact. It should also be noted that as the weather deteriorates these delay values will increase.

Exhibit 15 shows that EDF will benefit from the elimination of the ANC/EDF interaction.

Exhibit 15 – Annual Delay Hours - EDF

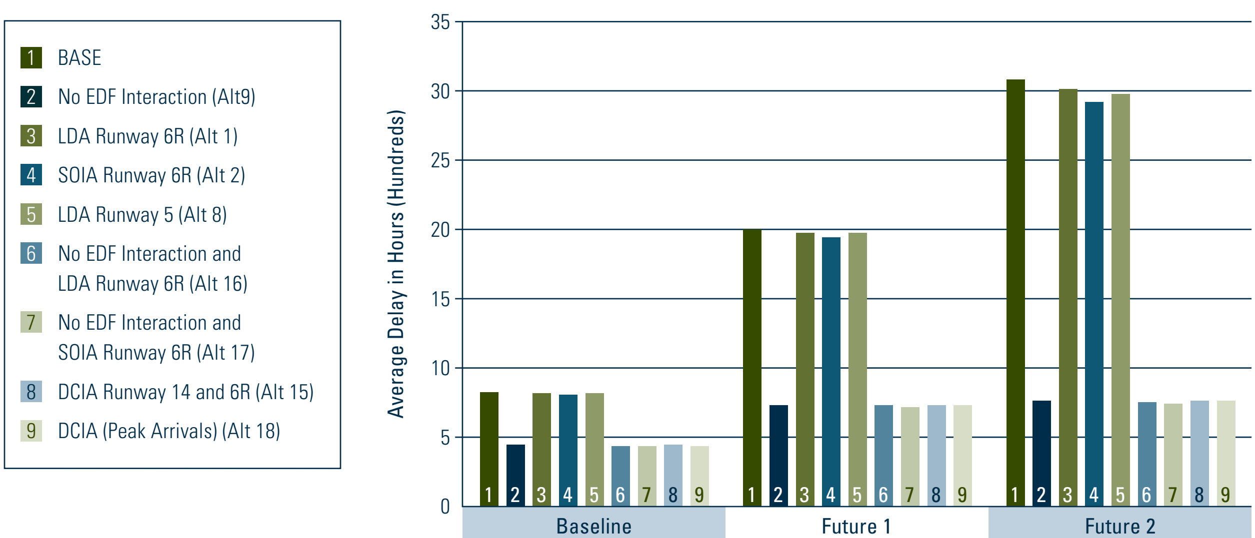


Exhibit 16 indicates that MRI will benefit from the elimination of the MRI/EDF interaction.

Exhibit 16 – Annual Delay Hours - MRI

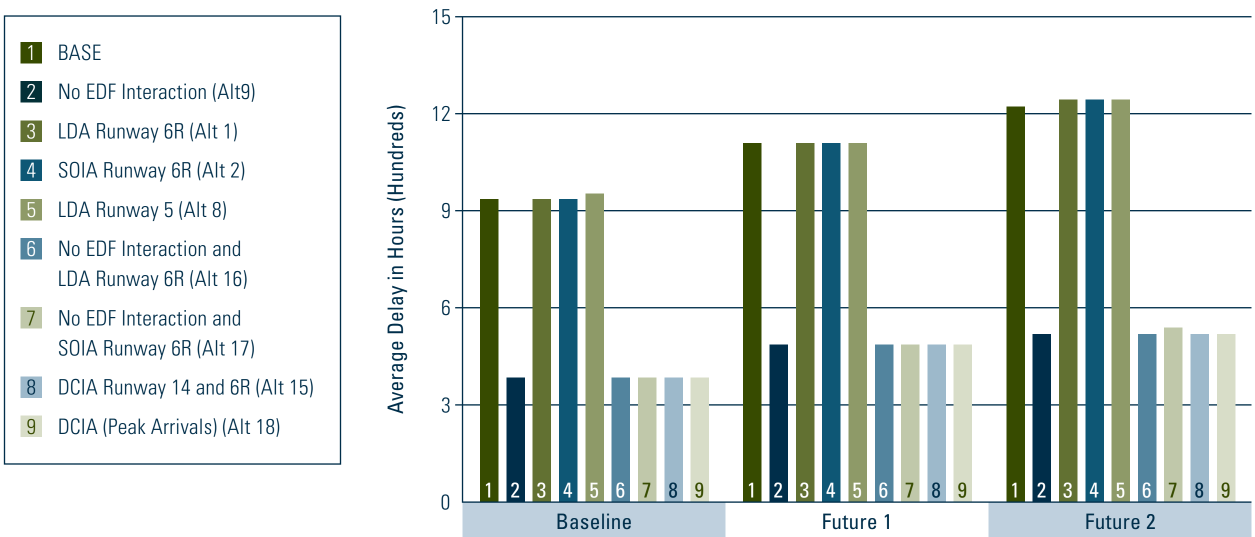
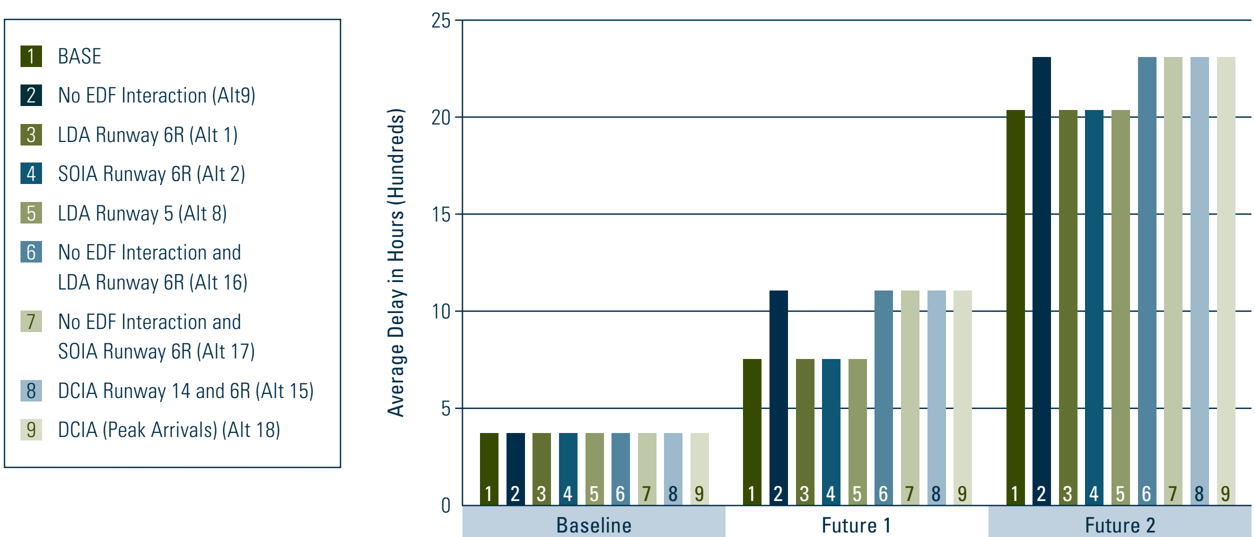


Exhibit 17 indicates that LHD will not benefit from the elimination of the ANC/EDF interaction. The problem here is that the interaction of ANC and LHD still exists. When the ANC/EDF interaction is eliminated the ANC traffic flow increases, thus increasing the interaction with LHD. Although there is an impact to LHD, the overall delay in the Anchorage Area will decrease with the elimination of the ANC/EDF interaction.

Exhibit 17 – Annual Delay Hours - LHD



VFR Corridor Traffic Delays

For most configurations, the delays associated with the VFR corridor traffic were 1 minute of delay per aircraft or less. The only significant delay in corridor traffic happens at the Future 2 demand level, SVFR, under Configuration B. During this scenario, the delay reached close to 17 minutes of delay per aircraft. The elimination of the EDF interaction scenario decreased the value to 1 minute of delay per aircraft.

Exhibit 18 shows the annual costs in dollars for the baseline configuration and the alternatives that were expected to provide some benefit. The annual delay costs in dollars were calculated by multiplying the annual delay in hours by the average cost per minute then multiplying by 60.

Exhibit 18 – Annual Delay Costs - All Airports

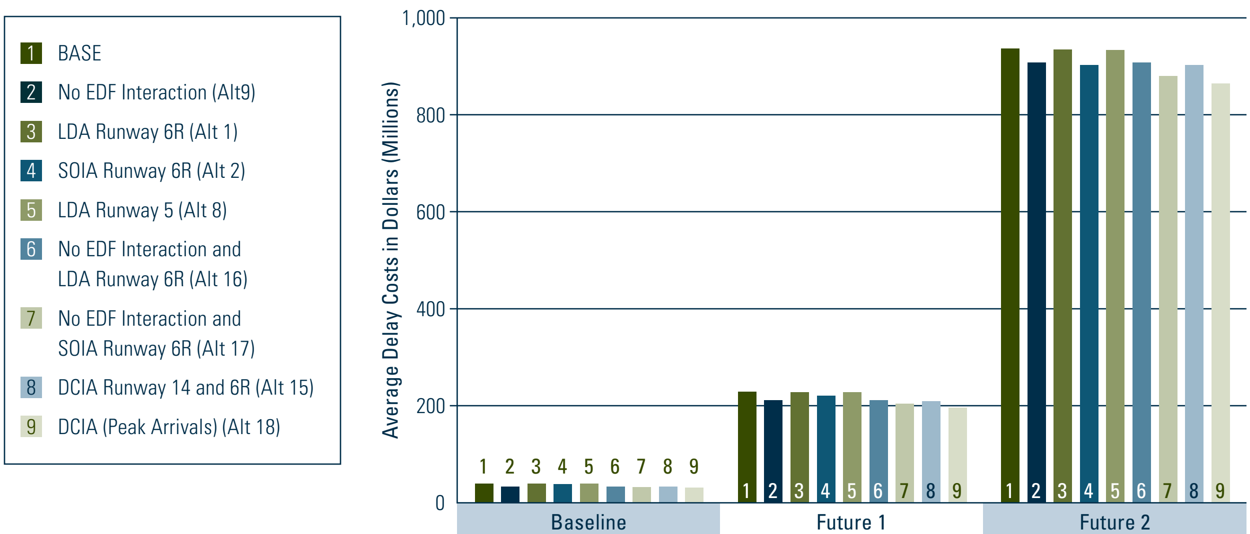
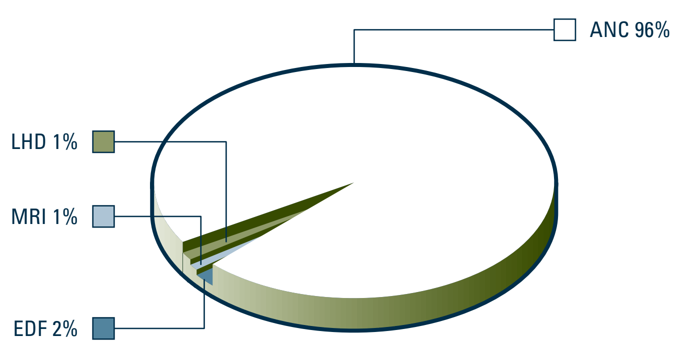


Exhibit 19 shows that most of the delay in the Anchorage area is ANC's.

Exhibit 19 – Annual Delay Hour Percentages for F2 Demand - All Airports



Conclusions and Recommendations

1 – As air traffic operational levels increase in the Anchorage Area, delays will increase dramatically, especially between the Future 1 and Future 2 operational levels.

2 – The procedural alternatives evaluated in this study will not provide a long-term solution to the projected future delays in the Anchorage Area. We do recommend assessing the feasibility of implementing the following procedural alternatives to reduce delays in the short term. These alternatives are focused on refinements to the existing airspace structure. Airfield and major airspace restructuring alternatives were not evaluated. Additional analysis will be needed to address long term delays in the Anchorage Area.

3 – Exhibit 20 presents the annual cost savings for the alternatives that are expected to provide a benefit. The annualized daily average delay at the Future 2 demand level for ANC exceeds 28 minutes even with the use of the proposed alternatives. Therefore, the Future 2 level of demand will not be achievable, unless other major capacity enhancements are implemented. Hence, the cost savings are shown for the Baseline and Future 1 demand levels only.

4 – The delay numbers depicted in this report represent both airport and airspace delays.

5 – This Airspace Study has provided valuable baseline data for ongoing and future planning related to airport master plans, aviation system plans, and airspace redesign and analysis.

Exhibit 20 – Annual Cost Savings for Each Alternative

	Baseline	Future 1
LDA Runway 6R (Alt 1)	$88,981.00	$443,696
SOIA Runway 6R (Alt 2)	$939,594.00	$7,417,792.00
LDA Runway 5 (Alt 8)	$126,174.00	$580,475.00
No EDF Interaction (Alt 9)	$6,156,473.00	$17,554,035.00
DCIA Runway 14 and 6R (Alt 15)	$6,296,785.00	$19,432,180.00
No EDF Interaction and LDA Runway 6R (Alt 16)	$6,117,752.00	$17,494,843.00
No EDF Interaction and SOIA Runway 6R (Alt 17)	$6,892,810.00	$23,929,092.00
DCIA (Peak Arrivals) (Alt 18)	$7,713,145.00	$32,548,370.00

Additionally, the ongoing Master Plan update for Anchorage International Airport will identify airfield capacity enhancement projects to address delays associated with the airfield infrastructure. The Airspace Restructuring Initiative will analyze more comprehensive changes in the Airspace structure to reduce delays. Following completion of the ANC Master Plan Update and the Airspace Restructuring Initiative, a second Anchorage Area Airspace Study is recommended.

Appendix A – Participants

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Alaskan Region

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Jerry Nunnally

Anchorage Airport Traffic Control Tower

Kent Peterson | Bev Sinnott-Maynard | Bill Chord

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United States Army

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Appendix A – Participants

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Philip Bray

Airline Pilot's Association
Chris Armstrong

University of Alaska
Robb Jones

Alaska Airmen's Association
Felix Maguire

Alaska Seaplane Association
John Pratt

Alaskan Aviation Safety Foundation
Virginia R. Hyatt   Tom Wardleigh

MRI Airport Commission
Mathea Doyle

Lake Hood Pilot's Association
Rudy Berus

Alaska 99's
Gail Rigden

Appendix B – Computer Models and Methodology

Airport and Airspace Simulation Model (SIMMOD)

SIMMOD is a fast-time, event-step model that simulates the real-world process by which aircraft fly through air traffic controlled en route and terminal airspace and arrive and depart airports. SIMMOD traces the movement of individual aircraft as they travel through the gate, taxiway, runway, and airspace system and detects potential violations of separations and operation procedures. It simulates the air traffic control actions required to resolve potential conflicts to insure that aircraft operate within procedural rules. Aircraft travel time, delay, and traffic statistics are computed and provided as model outputs. The model was calibrated for this study against field data collected at ANC to ensure it was site specific. Inputs for the simulation model were also derived from empirical field data. The model repeated each experiment 10 times using Monte Carlo sampling techniques to introduce system variability. The results were then average to produce output statistics.

Methodology

Model simulations included present and future air traffic control procedures, various airfield improvements, and traffic demands for different times. To assess the benefits of proposed airfield improvements, the FAA used different airfield configurations derived from present and projected airport layouts. The projected implementation time for air traffic control procedures and system improvements determined the aircraft separations used for IFR and VFR weather simulations.

For the delay analysis, agency specialists developed traffic demands based on the Official Airline Guide, historical data, and various forecasts. Aircraft volume, mix and peaking characteristics were developed for three demand periods (Baseline, Future 1, and Future 2). The estimated annual delays for the proposed improvement options were calculated from the experimental results. These estimates took into account the yearly variations in runway configurations, weather, and demand based on historical data.

The potential delay reductions for each improvement were assessed by comparing the annual delay estimates with the Do Nothing case.

The SIMMOD model was used to perform the capacity analysis for ANC.

Appendix C – List of Abbreviations and Acronyms

ANC	Anchorage International Airport
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Tracking System
ASR-9	Airport Surveillance Radar - Model 9
ATCT	Air Traffic Control Tower
BTS	Bureau of Transportation Statistics
CODAS	Consolidated Operations and Delay Analysis System
CRDA	Converging Runway Display Aid
DCIA	Dependent Converging Instrument Approaches
DOT	Department of Transportation
EDF	Elmendorf Air Force Base
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
GPS	Global Positioning System
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INS	Inertial Navigation System
LDA	Localizer Directional Aid
LHD	Lake Hood Seaplane Facility
MRI	Merrill Field l Airport
PF	Public Facilities
PRM	Precision Runway Monitor
SCIA	Simultaneous Converging Instrument Approaches
SID	Standard Instrument Departure
SIMMOD	The Airport and Airspace Simulation Model
SOIA	Simultaneous Offset Independent Approaches
STAR	Standard Terminal Arrival Route
SVFR	Special Visual Flight Rules
TRACON	Terminal Radar Approach Control Facility
VFR	Visual Flight Rules

Appendix D – Definition of Terms

Aircraft Separation Data

The arrival to arrival, departure to departures, arrival to departure, and departure to arrival Air Traffic rules and dependencies for separating aircraft.

Airport Configuration Data

The duration of time and percent of the year the airport is in a certain configuration for the arrival and departing traffic. Typically the configurations are dependent upon weather and wind condition.

Airspace Interactions

When two or more aircraft are attempting to use the same airspace, typically in crossing or converging, arriving and departing aircraft. The Air Traffic Controller may need to instruct the pilots to maneuver one, both or all or the aircraft to maintain proper separation.

Arrival Delay

These metrics indicate whether there are arrival delays associated with an airport. If significant delays are observed then the Airline Arrival Scheduling metric is useful to determine whether the delays are associated with airline over scheduling, or an airspace problem.

Arrival and Departure Fixes

Points in space that aircraft navigate to and over for efficient traffic flows.

Daily Demand Numbers

The number of aircraft arriving and departing hourly throughout a day. Typically a busy day of the busiest month, referred to as an average day-peak month. The demand is forecasted for the Future 1 and 2 scenarios.

Departure Delays

These metrics indicate whether there are departure delays associated with an airport. If significant delays are observed, then Airline Arrival Scheduling metric is useful to determine whether the delays are associated with airline over scheduling, or an airspace problem. The delays associated with a particular fix may also be measured to focus in further on the airspace problem.

Runway Occupancy Times (ROT)

The duration of time an aircraft is on the runway. Typically measured from crossing the threshold to exiting the runway (when the tail of the aircraft clears the runway).

Sets of Data Inputs
The collection of the information on how the aircraft operate on any airport. That data is use as inputs into the computer simulation model to measure the amount of delay.

System Delay
Delay is categorized here as arrival, departure or ground delays associated with a particular airport.